GREAT LAKES INDIAN FISH AND WILDLIFE COMMISSION

P. O. Box 9 • Odanah, WI 54861 • 715/682-6619 • FAX 715/682-9294

• MEMBER TRIBES •

MICHIGAN	WISCONSIN		MINNESOTA
Bay Mills Community	Bad River Band	Red Cliff Band	Fond du Lac Band
Keweenaw Bay Community	Lac Courte Oreilles Band	St. Croix Chippewa	Mille Lacs Band
Lac Vieux Desert Band	Lac du Flambeau Band	Sokaogon Chippewa	

Via Electronic Mail / Original by Mail

July 8, 2012

Steve Casey
Upper Peninsula District Supervisor
Water Resources Division
KI Sawyer International Airport & Business Center
420 Fifth Street
Gwinn, MI 49844

Re: Application for permit 12-27-0001-P to impact Streams and Wetlands

Dear Mr. Casey,

Below are GLIFWC staff comments on the permit application for stream and wetland fill at the proposed Orvana Copperwood mine. GLIFWC is acting in coordination with our member tribes to review and contribute to the Orvana review process. As you may know, GLIFWC is an organization exercising delegated authority from 11 federally recognized Ojibwe (or Chippewa) tribes in Wisconsin, Michigan and Minnesota.[1] Those tribes have reserved hunting, fishing and gathering rights in territories ceded in various treaties with the United States. GLIFWC's mission is to assist its member tribes in the conservation and management of natural resources in the ceded territories and to protect habitats and ecosystems that support those resources. The proposed Copperwood mine is located within the territory ceded by the Treaty of 1842. Our member tribes retain rights to natural resources within that ceded territory.

Staff's general observation is that Orvana's application for permit under WRD's Part 303/ 301, Inland Lakes and Streams is a good initial outline but does not describe the project or environmental controls in sufficient detail to provide for effective review or evaluation of possible impacts. In fact, we were unable to find any mine plan that described how the various alternatives and recommendations would be implemented. A mine plan was described for the Part 632 mine permit but aspects of that plan appear to have changed in some ways. These comments are based on our best guess as to what the current mine plan may be.

---

[1] GLIFWC member tribes are: in Wisconsin -- the Bad River Band of the Lake Superior Tribe of Chippewa Indians, Lac du Flambeau Band of Lake Superior Chippewa Indians, Lac Courte Oreilles Band of Lake Superior Chippewa Indians, St. Croix Chippewa Indians of Wisconsin, Sokaogon Chippewa Community of the Mole Lake Band, and Red Cliff Band of Lake Superior Chippewa Indians; in Minnesota -- Fond du Lac Chippewa Tribe, and Mille Lacs Band of Chippewa Indians; and in Michigan -- Bay Mills Indian Community, Keweenaw Bay Indian Community, and Lac Vieux Desert Band of Lake Superior Chippewa Indians.

Based on review of the Part 632 Mine Permit Application (MPA), the Part 303/301 Environmental Assessment (303/301 EA), the Part 303/301 Alternatives Analysis (303/301 AA) and other permit application materials available at the DEQ web site (http://www.michigan.gov/deq/0,4561,7-135-3307_29692_24403-279223--,00.html) it appears that the project could have substantial impacts to streams and wetlands but that there has been inadequate effort to develop and consider alternatives that avoid or minimize those impacts.

Aspects of the Mine Project that Would Impact Streams and Wetlands

Surface Disposal of Tailings

Orvana proposes to dispose of mine tailings in a surface facility that would cover approximately 300 acres of upland, 52 acres of wetland, and 13,000 feet of streams. The surface disposal of tailings is inappropriate. Orvana's consultant, Knight Piesold, points out some of the benefits of mine backfill with tailings on page ES-6 of Appendix B:

> "Alternative Tailings Disposal
> The TDF design has been developed assuming the storage of 100 percent of the tailings from the mine at surface. However, the footprint of the TDF could be significantly reduced if some of the tailings can be used as backfill for the underground mine. The reduction of the tailings stored at surface would reduce the required dike construction, surface water diversions, and wetlands impact and thus the total construction and closure costs of the facility. Further engineering studies would be required on potential methods to thicken or filter the tailings in order to produce a suitable material for backfill. The technical feasibility of this alternative would need to be assessed including a tradeoff study of the reduced footprint of the TDF and wetlands implications, construction costs, and operating costs associated with a thickened or filtered tailings plant."

As succinctly stated in Rock Mechanics for Underground Mining[2] "The current position in technically advanced countries is that very little metalliferous mining, undertaken using pillar support, is not accompanied by subsequent stope filling and pillar mining." There are many sources of information regarding backfilling of room and pillar mines[3,4,5], particularly with final pillar removal, as is proposed by Orvana. The use of backfill in coal[6] and hardrock mining dates

---

[2]Barry H. G. Brady, Edwin T. Brown. 2004. Rock mechanics: for underground mining 3rd edition Springer Science p. 626

[3]D.R. Tesarik, J.B. Seymour, and T.R. Yanske, 2009, Long-term stability of a backfilled room-and-pillar test section at the Buick Mine, Missouri, USA, Int. J. Rock Mech. Min. Sci., 46, p.1182.

[4] W.G. Hunt, 1990. The Use Of Consolidated Backfill For Pillar Recovery In Room and Pillar Mining: An Integrated Design Rationale. McGill U. Thesis. p. 180

[5] Backfill of Tailings to Underground Workings (http://www.tailings.info/backfill.htm)

[6] J. Donovan, 1999. The effects of backfilling on ground control and recovery in thin-seam coal mining. VPI&SU Thesis p. 148

550 Babcock Dr., Rm. B102
Madison, WI 53706
608-263-2873 Fax 608-262-2500

back at least 30 years and is a well established technology [7]. Cemented backfill would not only greatly reduce impacts to wetlands and streams but also provide long-term stability and reduce the flux of mine reflood waters to local aquifers or the surface. The DEQ should require further engineering studies of backfill feasability. These studies should be available for review and comment.

Tailings Basin Construction and Operation

Liner Design: As noted in our earlier comments, the proposed liner system is inadequately described and does not comply with Part 632, R425.409. It is impossible to determine if the proposed liner would adequately protect stream and wetland ecosystems from contaminants, because inadequate detail is provided. DEQ has stated that further design evaluation will occur and a final design selected, however, such statements do not provide the public or governmental agencies anything to evaluate.

Long-term Seepage: Given the design proposed by Orvana, with an underdrain draining to the north-west corner and plugging of the drain post-mining, the likely point of seepage discharge from the base of the TDF would be at the northwest corner. Because of the high hydrostatic head that could develop at that NW point, the tailings seepage would eventually penetrate the TDF berm, and likely daylight to surface at the toe of the tailings basin near Namebinag Creek. Previous DEQ and/or Orvana responses on this issue have been less than informative. No studies of the long-term post-mining TDF water budget have been presented. The impacts of long-term seepage from the TDF needs to be accounted for in evaluation of direct and indirect impacts to stream and wetland ecosystems.

Leachate Water Quality: Surface and ground water standards are exceeded by predicted Tailings Disposal Facility (TDF) leachate. While, according to the MPA, the leachate would be treated during operations and for 5 years after mine closure, in the long-term the poor quality leachate would discharge to ground and surface waters near the TDF, adversely impacting stream and wetland ecosystems.

The long-term seepage from the TDF is predicted to be in the range of 0.21[8] to 0.55[9] inches/year, depending on the integrity of the cap and liner systems. In the long-term, because of loss of cap integrity, seepage would be higher. Tables 203.3.5-4a and 4b of the MPA predicts that at least 15 constituents in the TDF seepage would violate Lake Superior surface water standards, EPA Maximum Contaminant Levels, EPA Secondary Maximum Contaminant Levels, and/or MI Part 201 standards.

---

[7] I. Farmer, 1992. Room and Pillar Mining. SME mining engineering handbook / senior editor, Howard L. Hartman ; associate editors, Scott G. Britton ... [et al.]. Society for Mining, Metallurgy, and Exploration.

[8] The rate Knight Piesold estimates for percolation through the TDF cap. (see AP_B_text_1.pdf, pgs 5-14 to 5-17)

[9] The rate Knight Piesold estimates for percolation through the bottom of the TDF (see AP_B_text_1.pdf, pgs 3-8 and 5-6, and figure 3.1)

550 Babcock Dr., Rm. B102
Madison, WI 53706
608-263-2873 Fax 608-262-2500

Instability: The current TDF design appears potentially unstable post-closure because of high hydrostatic head pressure buildup once the bottom drain is closed. With the underdrain closed 5 years after the cessation of mining, as proposed in the MPA, hydrostatic head would build up on the base and berms until the seepage rate through the base and berms equals the influx through the cap. Long-term slope stability post mining has not been adequately evaluated. Failure of the TDF slopes would cause additional damage to streams and wetlands. Previous response by the DEQ and/or Orvana has not been informative. TDF stability must be fully evaluated before a permit decision.

Cap Design: Water that seeps through the cap into the tailings would build up in the tailings until discharge from the base equaled influx through the cap. As Knight Piesold states on page 3-8 of MPA-Appendix B: "the unit flux rate from the bottom of the TDF will be controlled by the amount of infiltration through the closure cap." Knight Piesold assumed 15% settling of the tailings that are, at their thickest, approximately 150 feet thick. This translates to 22.5 feet of settling in the north-west corner. This could lead to an essentially flat top. A flat cap would increase infiltration and the likelihood of slope failure. Previous response on this issue by the DEQ and/or Orvana has not been informative. A design that ensures minimal infiltration through the TDF cap must be articulated and evaluated before a permit decision.

Subsidence

The latest report on potential subsidence (Call & Nicholas Inc, 2012) indicates that subsidence would be in the range of 0 to 5.5 feet depending on the frequency of pillar collapse. Orvana states:

> "After secondary pillar extraction, the remaining pillars will not support the roof long-term. As a result, it is anticipated that subsidence of the overburden materials above the mine will occur." (303/301 EA, page 87).

Subsidence could alter existing topography and surface drainage. This alteration could destroy or create surface water features and should be accounted for in the analysis of environmental impacts of the site. Orvana recognizes that surface hydrology may be altered by subsidence and that "Downstream portions of the streams may be impacted by surface subsidence." (303/301 EA, page 87) yet does not analyze those impacts. On page 69 of the 303/301 EA Orvana states:

> "Cracks due to tough [sic] subsidence can extend outside of the mining limits. Crack limits in sedimentary racks [sic] range from 45 to 75 degrees. Considering the design of the proposed mining method and the known configuration of the geology in the mining area, no cracking is expected to be expressed outside of 500 feet from the mining operation."

The Call & Nicholas Inc. report (page 6-2) indicates that due to subsidence induced cracking of the strata, pillar removal should not take place any closer than 500 feet from Lake Superior. What seems to be overlooked is that cracking would not need to reach Lake Superior to have environmental impacts to streams and Lake Superior. Any cracking that reached the stream channels in the area would provide conduits for brines to be pushed to the surface by the post-mining hydrostatic head in the mine.

On page 67 of its 303/301 EA Orvana notes that Call & Nicholas Inc. "provides specific recommendations to limit the potential for observable ground surface subsidence", yet nowhere does Orvana propose or commit to implement those recommendations. For example, Call &

Nicholas Inc. recommends on page 1-3 of their report that there "should be no pillar recovery within 500 ft of Lake Superior", yet nowhere is this recommendation implemented in Orvana's mine plan. In fact, no clear mine plan is articulated in the permit application materials. Orvana should develop a mine plan that incorporates adequate protections to minimize subsidence.

Groundwater Drawdown

Drawdown of the water table in the upper glacial till is predicted to be 4 to 12 feet under a large portion of the wetlands and streams at the proposed mine site. Figures R-18.A, B & C and R-25.B & C of Orvana's January 6th response to the DEQ request for information on the MPA show the extent and magnitude of the drawdown under the streams and across the site. Figure R-25.C shows that all the streams, except East Gipsy, and the majority of site wetlands will experience at least 1 foot and as much as 12 feet of drawdown. Such extensive drawdown of the watertable across the entire area to be mined may have profound impact on the surface hydrology of the site. Orvana's consultant analysis suggests that the low permeability of the tills at the site will prevent substantial impacts to surface waters, however, that analysis does not appear to consider subsidence induced cracking identified in the Call & Nicholas Inc. report. The use of grouting and cemented backfill to reduce mine groundwater inflow and to minimize long-term disruption of the watertable by subsidence should be required in detail prior to a permit decision.

Wetland Fill and Drawdown

It is predicted that developing the TDF would fill approximately 52 acres of wetland. That is 90% of the total wetland fill from this project. Backfilling the underground mine during mining would result in a smaller TDF and could substantially reduce the acreage of wetland fill. Backfilling the mine is consistent with the goal of avoiding and reducing wetland fill in the Lake Superior basin. Although Orvana recognizes the possibility of damage to existing wetlands due to subsidence (MPA section 205.1.11.1), the 58 acres of wetland loss does not include adequate consideration of the wetlands that may be drained or otherwise damaged by subsidence or groundwater drawdown. This impact must be fully articulated and methods for minimizing impacts proposed in a mine plan prior to a permit decision.

Stream Fill and Drawdown

In addition to direct impact to 13,672 feet of channel, stream communities will be indirectly impacted by discharge, subsidence and drawdown of the watertable during mining. Post-mining, streams will be impacted by seepage from the TDF and seepage of brines from the reflooded mine workings. Although the discharge of treated wastewater will be regulated by a NPDES permit, the long-term seepage from the TDF and upwelling from the mined-out ore zone through old boreholes or subsidence induced channels is not considered in the application. Such discharges of poor quality water must be anticipated, described and planned for. Orvana's initial analysis predicted subsidence of up to 7 feet, and more recent analysis (Call & Nicholas Inc. 2012) predicts up to 5.5 feet of subsidence under some of the site streams. If subsidence induced cracking should reach the stream beds there could be substantial impact on stream hydrology and chemistry. Drawdown of the watertable is predicted to be more than 12 feet in the middle stretches of Namebinag and West Namebinag Creeks (MPA: Figures R-18.B and R-25.C). These indirect impacts to streams must be fully articulated and methods for minimizing those impacts proposed.

Enhanced Hydraulic Link Between Surface and Groundwaters

Water chemistry data from the mine site indicates that there is a hydraulic link between most of the site streams and deeper groundwater. A field visit the week of Jan. 9th, 2012 to the Lake Superior shore where streams from the Orvana site discharge to Lake Superior suggested that the streams are connected to groundwater. Despite an air temperature of 15 deg. F, we found several streams with substantial flow, and even more telling, Specific Conductance readings between 150 and 225 uS/cm. Water samples collected by the Lac Vieux Desert band in the last 2 years also show elevated Specific Conductance at the point where streams leave the site; readings as high as 563 uS/cm were recorded. GLIFWC staff have found that, typically, surface water in the Lake Superior basin with Specific Conductance above 100 uS/cm has either significant groundwater inputs or else is impacted by human activities. There has been little human activity at the site which might explain the elevated levels of Specific Conductance. Therefore, there is almost certainly a significant groundwater component to the local streams.

Examination of Orvana's surface water data (MPA, Appendix F 202.2.8-1) finds elevated Specific Conductance and Chloride in many of the streams passing through the proposed mine site. Precipitation derived surface water in the region typically has <5 mg/L of Cl, yet many of Orvana's stream samples show Chloride above 10 and in some cases above 50 mg/L. Of the 17 surface water sample sites, average chloride was above 10 mg/L at 7 sites (SW-B, SW-D, SW-F, SW-M, SW-N, SW-O and SW-P). The elevated Chloride and Specific Conductance indicates that the streams are receiving inputs from sources in the bedrock. Brines, high in Chloride, are known to occur at depth in this bedrock aquifer and were a source of large quantities of Chloride in discharge waters at the nearby White Pine mine during operations.

GLIFWC analysis and field observations, and Orvana's surface water quality data all indicate that many of the streams at the proposed mine site already have a connection to the underlying bedrock aquifer, contrary to Orvana's claim that "no evidence of groundwater discharge to surface water has been observed at the site." (303/301 EA page 59). While stream flows may be "flashy" and dominated by precipitation, Orvana's statements that the streams at the site are isolated from groundwater are simply not true, as demonstrated by the company's own water quality data. The connection between the deeper aquifer and the site surface waters is important in that it indicates that conduits for the movement of deeper brines already exist. Those conduits will likely be augmented by mining activity, subsidence induced cracking, and the increased upward head pressures generated by flooding the mine at closure.

Post-mining Brine/Contaminant Discharge from Mine Workings

Analysis of the relative heads and ground surface elevations show that after flooding of the mine, heads in the mine will be substantially above the ground elevation over much of the site (see attached memo of April 24, 2012). This will result in poor quality mine water being forced to the surface, impacting streams and stream-side wetlands. Historical boreholes that have never been abandoned and stress induced cracks in the formations will provide additional conduits beyond those that already exist. Chloride in site streams indicate that there is already upward movement of deep groundwaters to the streams. Those flows will be augmented by the high head pressures generated by flooding of the mine and by the additional conduits for flow caused by mining.

According to Orvana's report on geomechanics (Call & Nicholas Inc. 2012), even after secondary pillar recovery, a substantial number of pillars will remain for safety. Historical

borings that pass though those pillars can not be identified and grouted during mining. They will provide conduits for upward flow of mine waters, after flooding. Also according to the Call & Nicholas Inc. report, cracking of the formations is likely. Such cracks will provide additional conduits. The impact of flooding the mine to an elevation of approximately 700 feet and the surrounding aquifer pressures in the southern portion of the mine will result in post-mining head pressure in the mine of approximately 850 feet elevation. That head pressure is 240 feet above the ground elevation at the north-west portion of the site (see attached memo of April 24, 2012 for additional detail).

Backfilling of the mine with cemented tailings would, to a large extent, alleviate the threat of pressure induced upwelling of poor quality mine water and brines. The impact of mine water and brine discharge on stream and wetland ecosystems must be evaluated and avoidance and mitigation plans developed.

Post-mining Water Quality

In general, post-mining runoff and discharge water quality is inadequately addressed. There will be seepage from the TDF, runoff from the surface of the TDF and eventually from the tailings, and discharge from the reflooded mine workings by way of fissures and historical boreholes. The water quality discharging from the White Pine Mine, which mined the same type of ore, is informative. More than 15 years post mining, the water discharging from that site, which is a mix of mine waters and tailings runoff, still exceeds the applicable copper standard 15 to 20% of the time and substantial quantities of chloride continue to be discharged, particularly during high flow periods. At Copperwood, the long-term control of copper and chloride are not adequately addressed. These and other pollutants need to be controlled post-mining, by modification of the mine plan to dispose of tailings more safely and by prevention of the escape of brines from the reflooded mine.

Perpetual Care

TDF cap maintenance.-- The cap, drains and slopes of the TDF would require perpetual care to prevent erosion, infiltration into the tailings, and slope failure. Lack of maintenance would result in impacts to streams and wetlands. Knight Piesold states: "A maintenance bond will be established for periodic repair of the closure cap and spillway extending beyond at least the primary portion of the tailings consolidation process" (MPA, AP_B_text_1.pdf, end of section 5.10.1).

TDF seepage treatment.-- The low quality seepage from the TDF would need to be perpetually captured and treated in order to prevent groundwater and surface water contamination that would otherwise adversely impact stream and wetland ecosystems.

Control of mine waters and brines.-- As at the White Pine Mine, historical bore holes provide conduits for discharge of mine waters and brines, post-mining. As at White Pine, perpetual pumping would be needed to prevent uncontrolled discharge.

The MPA and the application under Part 303/301 proposes a project that would require long-term care and maintenance to prevent additional impacts to streams and wetlands, contrary to the requirements of Part 632.

550 Babcock Dr., Rm. B102
Madison, WI 53706
608-263-2873 Fax 608-262-2500

Alternatives Analysis

The information in the Alternatives Analysis document provides a brief outline of a limited set of alternatives. There is very little technical detail about the alternatives and there is little detail to justify the selection of one alternative over another. Clean Water Act (CWA) Section 404(b)(1) guidelines require an applicant to demonstrate that practicable alternatives do not exist which are less damaging to the aquatic environment. Without more detailed analysis it is not possible to identify the Least Environmentally Damaging Practicable Alternative (LEDPA) for this project. Permits should not be granted until the applicant has developed this analysis.

CWA Section 404(b)(1) also requires that the applicant avoid, minimize and mitigate impacts to wetlands to the furthest extent possible, in that order. The lack of detail and analysis in the alternatives section means that there is no way for a reviewer to know if this process has been followed.

Section 4.0 Construction of the Mill site

Page 8 of the Alternatives Analysis document indicates that concentrate will be shipped off site for smelting. Contamination from concentrate spills along transportation routes has been well documented at other sites. Where will the concentrate be shipped and how have the impacts along transportation routes been assessed? The impacts of copper ore dust spills are currently being assessed at the PolyMet mine in Minnesota and this analysis is being used to calculate the overall contaminant source term for the project. A similar analysis is needed for this project.

Section 5.0 Tailings Disposal Facility

Disposal alternative 1 presented in the document is likely the least environmentally damaging. As indicated in GLIFWC's comments on Surface Disposal of Tainlings, above, backfill of underground mines is standard industry practice and Orvana's consultant enumerates several of the environmental benefits of backfill at this project. Benefits would include:

- Reduced surface subsidence
- Reduced height and footprint of the permanent tailings facility
- Reduced filling of stream segments and wetlands
- Reduced need for long term water capture and treatment
- Increased stability of the TDF.
- Reduced post-mining mine water/brine discharge through historical bore holes.

It appears that the applicant has not conducted the studies that are recommended by its consultant, Knight Piesold, before eliminating the backfill alternative from further consideration. Page 13 of the Alternatives Analysis document states that some geotechnical work will be done in the future and only then would backfilling be considered. It is standard practice to conduct such analysis during the environmental analysis phase in order to identify the LEDPA for a project. Finally, the applicant does not provide any detailed technical or economic justification for eliminating this alternative. Page 12 lists some vague reasons why this alternative would not be selected but those reasons are related to the overall mine plan, which could be modified. The applicant has not conducted the analysis necessary to eliminate this alternative from further consideration. Such analysis must be done.

No Alternatives for Ore Extraction or Mining Plan

The list of alternatives is not complete. Page 69 of the Environmental Assessment indicates that several options to reduce subsidence were explored. However, these options are not described. These options should be presented in the alternatives section and analyzed for their potential environmental benefits. It appears that the single mine plan is constraining the development of alternatives for other parts of the project as well as the level of analysis that those alternatives have received. The applicants' verbiage rejecting the backfill alternative states that the mine plan does not allow backfilling to occur and that the mine plan only allows "certain levels of advance" (Page 12). This suggests that the applicant has not considered alternative mining plans. If in fact backfill is not possible with the current mining plan, why have alternate mining plans not been developed that would allow backfill?

What is particularly curious is that the brief description of why the mining sequence is incompatible with backfilling (303/301 AA, page 12) would appear to be a description of exactly the type of mining sequence that would be an appropriate framework for backfilling. For example, Orvana states that it would take 4 years of mining before the northern portion of the mine would be reached and 4 years worth of tailings would need to be stored above ground. That is exactly what one might expect for any mine that implemented backfilling. Typically initial years of mine waste are stored above ground, potentially permanently because of the inability of the mine to hold all the mine waste. In later years of mine development, mine waste could be backfilled because there have been voids created by earlier mining. For a mine with a 13 year operations life, as Orvana proposes, one might find that the first 5 or more years of waste need to be permanently stored above ground and ultimately approximately 50% of the mine waste would be returned to the mined out void as cemented backfill. Orvana's verbiage in their Alternatives Analysis provides no logical justification for why backfill at Copperwood is any less feasible that it would be at other mines. Finally, Orvana's claim that only 25% of the waste could be backfilled because of the addition of 1:1 cement to tailings suggests either a lack of knowledge of mixing ratios for cemented backfill or an unusual situation at Copperwood. Cement additions closer to 3-10% of the final mix are more typical[10,11,12]. If Orvana has information that demonstrates the need for a 1:1 cement to tailings mix and other factors that would reduce the feasibility of cemented paste backfill, those facts should be presented in the Alternatives Analysis.

No Alternatives for Discharge from Waste Water Treatment Plant

Page 54 of the Environmental Assessment states that three alternatives were considered for discharging treated water. These alternatives are not mentioned in the alternatives document and no analysis is provided regarding the benefits of one over another or how the different

---

[10] Clark, C. C. , Vickery, J. D. and Backer, R. R. 1995. Transport of Total Tailings Paste Backfill. United States Bureau of Mines. Report of Investigations 9573.

[11] Tesarik, D.R. Seymour, J.B. and Yanske, T.R. 2009. Long-term stability of a backfilled room-and-pillar test section at the Buick Mine, Missouri, USA, Int. J. Rock Mech. Min. Sci., 46(2009), p.1182.

[12] Crandon Mining Co. 1995. Mine Permit Application. Section 4.9.2.8.

550 Babcock Dr., Rm. B102
Madison, WI 53706
608-263-2873 Fax 608-262-2500

alternatives may influence stream flows or other direct or indirect impacts to aquatic systems. Both the 303/301 permit application and the proposed NPDES permit application would benefit from a complete analysis of possible alternatives in order to meet the CWA requirements of avoidance and minimization of impacts to stream and wetland communities.

Environmental Assessment

Little detail on specific impacts is provided in the Environmental Assessment. The document contains a set of general impacts which would be expected at most large scale mine operations. The mitigation options that are discussed are in large part a restatement of the mine plan and are not specific mitigation proposals that can be evaluated to develop a LEDPA.

There is little information about mine closure. The tailings facility would become a permanent feature of the landscape and would require some form of perpetual care to maintain the cap and prevent seepage to ground and surface waters. Information should be provided about the long term maintenance needs of the cap and liner systems, drain systems, post closure water treatment needs, and geotechnical stability. If there is a failure to maintain the integrity of the cap, water will enter the tailings pile and tailings may be exposed to weathering and erosion. The water quality leaving the uncaped White Pine Mine tailings basins continues to contain copper levels that exceed water quality standards 15 to 20 % of the time, even though the mine has been closed for more than 15 years. The potential for escape of mine waters post-mining and methods for their containment need to be evaluated and discussed.

Section 6.2.1 Potential Impacts to Existing Water Budget

There is no information about the contributions of water pumped from Lake Superior to the budget of the site streams. This pumping of water from Lake Superior and discharge of that water to Namebinag Creek is an integral part of the project and the effects on stream water budgets should be fully analyzed and described in this section. The impact of diverting Gipsy Creek into Namebinag Creek may have substantial impact during high flow periods and should be analyzed.

Section 6.5.1 Potential Impacts to Surface Water Quality

This section states that no long term impacts are expected. However, there is no information about post-closure long term maintenance and water treatment needs of the project. Nor does this section discuss the discharge of mine waters, post flooding, by way of historical bore holes and mining induced fissures. This section should be revised with adequate information on post mining water treatment needs and potential for discharge of mine waters.

Section 6.5.5 Treated Water Discharge

This section does not have any information on the length of time that the plant will need to operate after closure. Water from the tailings facility will need to be treated for a certain period of time after operations have stopped. A detailed post-mining water budget for the TDF that includes seepage rates through the cap and liner/drainage systems should be conducted to evaluate the potential for long-term generation of seepage from the facility. Analysis of the long term generation of water that requires treatment and the operation of the WWTF is needed.

Section 6.5.8 Proposed Measures to Reduce and Mitigate Potential Impacts

We presume this section is intended to discuss mitigation measures for the Milling and TDF operations. This section does not describe mitigation measures beyond previous statements in other portions of the permit application or else vague statements of intent. Vague promises to minimize impacts are not a description of mitigation measures. Mitigation measures need to be described in detail so that their potential effectiveness can be evaluated.

Section 6.6.5 Proposed Measures to Reduce and Mitigate Potential Impacts

We presume this section is intended to discuss mitigation measures for wetland impacts. This section restates the requirement of avoiding, minimizing and mitigating but does not describe how that would be done. This is not a discussion of mitigation measures but rather a restatement of broad goals.

Section 6.7.3 Potential Impacts to Parks and Wilderness Areas

This section states that noise impacts may affect the North Country National Scenic Trail (NCNST). However, no analysis of the magnitude of the impacts is provided and no decibel levels for the impacts are presented. The applicant's conclusion that the impacts are not significant is not supported by any data or analysis. A data driven analysis of potential impacts to the NCNST must be developed.

Section 6.11.4 Proposed Measures to Reduce or Mitigate Potential Impacts

This section only states general measures that might be considered to control invasive species. It does not include any commitments or a proposal for what would be done at the site to minimize impacts from invasive species. A invasive species control plan should be developed and presented in the application for evaluation.

Section 7.1 Cumulative Impacts

This section ignores past mining activity. Extensive mining has occurred for over 150 years in the area. In addition, the White Pine mine operates east of the proposed Copperwood project. The tailings basins at that site continue to discharge water with TDS and copper content that exceed standards. The flooding process for that mine will have to be managed in perpetuity to prevent brine discharges. The presence of waste rock from previous mining at the Copperwood site is not discussed, nor is how leaching from that rock may combine with project discharges to impact site waters. The cumulative impact section does not contain useful information on cumulative impacts and should be rewritten.

Section 7.2 Additive Impacts

This section does not contain any analysis of additive impacts. For example, what is the effect of air emissions, groundwater discharge, surface water discharge, and contamination along transportation routes on stream or wetland water quality? The additive impacts on streams of post-mining tailings basin seepage and mine water discharge from historical bore holes should be evaluated as well. Analysis of additive impacts is needed in multiple areas.

Indirect Impacts

This project has potential for many indirect impacts to streams and wetlands: groundwater drawdown, chemical changes in wetlands or stream communities due to air deposition, TDF seepage, treated water discharge, or post mining discharge from historical bore

holes. Given the high heads that will be generated by flooding of the mine, flooding of wetlands and streams with excess water that discharges from historical bore holes may also be a problem. Few of these indirect impacts have been considered in the permit application. The environmental analysis for this project is incomplete and needs to cover all reasonably possible indirect impacts. Page 54 of the Environmental Assessment states that a NPDES permit will be required for discharge of waste waters. However, the 303/301 permit review must consider the indirect and additive impacts of the discharge of those waters on stream and wetland communities.

The permit application and associated materials do not adequately consider reasonable alternatives, do not present a rational discussion of the pros and cons of the alternatives that are considered and overlooks most indirect, additive and cumulative impacts of the mine project. It appears that alternatives that strive to avoid and minimize both direct and indirect impacts of the project have not been carefully considered. If they have been considered, that analysis is not presented in the application materials. Without more complete consideration of alternatives, more complete data-driven analysis of the alternatives considered and consideration of indirect, additive and cumulative impacts it would be impossible to determine the least environmentally damaging practicable alternative or propose adequate permit conditions.

Thank you for the opportunity to comment on this permit application. We would be glad to discuss these issues with you or your staff. We look forward to reviewing a more complete application when it becomes available.

Sincerely,

John Coleman

John Coleman, GLIFWC Environmental Section leader

cc: James Caron, MI-DEQ, Crystal Falls Office
Melanie Haveman, USEPA Wetlands and streams
Bob Deroche, Marquette Field Office, USACE
Neil Kmiecik, GLIFWC Biological Services Director
Ann McCammon Soltis, GLIFWC Policy Analyst

550 Babcock Dr., Rm. B102
Madison, WI 53706
608-263-2873 Fax 608-262-2500

GREAT LAKES INDIAN FISH AND WILDLIFE COMMISSION

P. O. Box 9 • Odanah, WI 54861 • 715/682-6619 • FAX 715/682-9294

• MEMBER TRIBES •

MICHIGAN	WISCONSIN		MINNESOTA
Bay Mills Community	Bad River Band	Red Cliff Band	Fond du Lac Band
Keweenaw Bay Community	Lac Courte Oreilles Band	St. Croix Chippewa	Mille Lacs Band
Lac Vieux Desert Band	Lac du Flambeau Band	Sokaogon Chippewa	

Via Electronic Mail / Original by Mail

April 24, 2012

Memorandum

To: Harold Fitch MDEQ, Office of Oil, Gas, and Minerals
Joe Maki, MDEQ, Mine Review Team Coordinator

From: John Coleman, Environmental Section Leader

Re: Copperwood Mine discharge from workings due to high head pressure

After submitting GLIFWC's 2012-04-09 comments concerning the proposed Michigan permit for Orvana's Copperwood project I became aware of an additional issue that appears to be environmentally significant. The final reflooded mine head pressure across most of the mine site, at the box-cut portal area, and at historical exploratory boreholes will be substantially above ground elevation (Figure 1, attached). The relevant facts I have gathered from the Mine Permit Application (MPA) and the Orvana 2011-12-28/2012-01-06 Responses to MDEQ questions (Orvana Responses) are:

- Head in the bedrock aquifer surrounding the south-east corner of the reflooded mine is expected to be at an elevation of 850 feet (Orvana Responses, Appen_202.5.2-2b, attached).
- The mouth of the box-cut portal is at an elevation of 650 feet and the land surface at the box-cut is at an elevation of 740 feet (MPA, Fig. 16.30, attached).
- The surface elevation at the north-west portion of the mine area is at an elevation of 620 feet (Orvana Responses, Fig. R-109B, attached).
- There were 161 holes drilled by USMR and 23 holed drilled by BCM in the 1950s in the area. (MPA, page 2).
- There are no records with the State of Michigan identifying abandonment (i.e. plugging) of any of those bore holes (Melanie Humphrey, MDEQ, personal communication).
- There are brines in the bedrock formations at the Copperwood site and these are expected to enter the mine during mining and post-mining (MPA, page 165).
- Post-mining, Orvana proposes to flood the mine with fresh water in an attempt to suppress the brines in the mined out workings (MPA, page 165).

Examination of the physical structure of the proposed mine, the topography and the groundwater hydrology indicates that:

-Flooding the mine with fresh water to the top of the mine workings will raise water levels in the mine to an elevation of approximately 700 feet.

550 Babcock Dr., Rm. B102
Madison, WI 53706
608-263-2873 Fax 608-262-2500

-Natural inflow from the surrounding aquifer in the south-east portion of the mine workings will raise the head pressure in the mine to an elevation of approximately 850 feet.

-The final head pressure in the reflooded, sealed mine workings will be approximately at an elevation of 850 feet, which is 240 feet above the ground surface in the north-west portion of the mine site.

Conclusions based on the proposed mine, historical activities, and the site's hydrogeology:

-The excess head pressure in the reflooded mine of up to 240 feet above ground surface will tend to force brines in the lowest reaches of the mine up and out of the historical borings across the site, particularly in the north-west near Lake Superior.

-The excess head pressure in the reflooded mine at the box-cut portal will be 110 feet above ground surface (i.e. 850-740). This will tend to force water out of the portal area. It is unclear if proposed plugging of the portal is adequate to prevent discharge.

-There is no stated plan in the MPA or Orvana's Responses for locating all historical borings so that they can be plugged. Orvana only proposes to plug the historical borings during mining if they are producing significant inflow of water (Orvana Responses of 2011-12-28, page 7).

-The relationship of head in the reflooded mine water and brines at Orvana to the ground surface is likely to be similar to, but more extreme than, the relationship found at the White Pine Mine, where pumping is being used to prevent the escape of water/brines from the reflooded mine (Figure XSECT-HH, attached).

It appears that the proposed mine plan would create post-mining heads in the reflooded mine void that far exceed the elevation of the land surface over much of the site. This high head pressure would drive mine waters to the surface by whatever conduits exist or are created, be they old boreholes, the portal, or caving induced fissures. The expected poor quality of the mine water would impact surface and ground waters. These impacts do not appear to have been considered in the permit application or in permit conditions.

Thank you for considering these points and I look forward to opportunities to discuss this and other Copperwood issues with you.

cc: Jean Battle, USACE, Regulatory Project Manager
Melanie Haveman, USEPA, Watersheds and Wetlands
Ross Micham, EPA, UIC Program
John Konik, USACE, Chief Regulatory Office
Melanie Humphrey, MDEQ Mine Review Team Co-Coordinator
Neil Kmiecik, GLIFWC Biological Services Director
Ann McCammon Soltis, GLIFWC Policy Analyst

550 Babcock Dr., Rm. B102
Madison, WI 53706
608-263-2873 Fax 608-262-2500

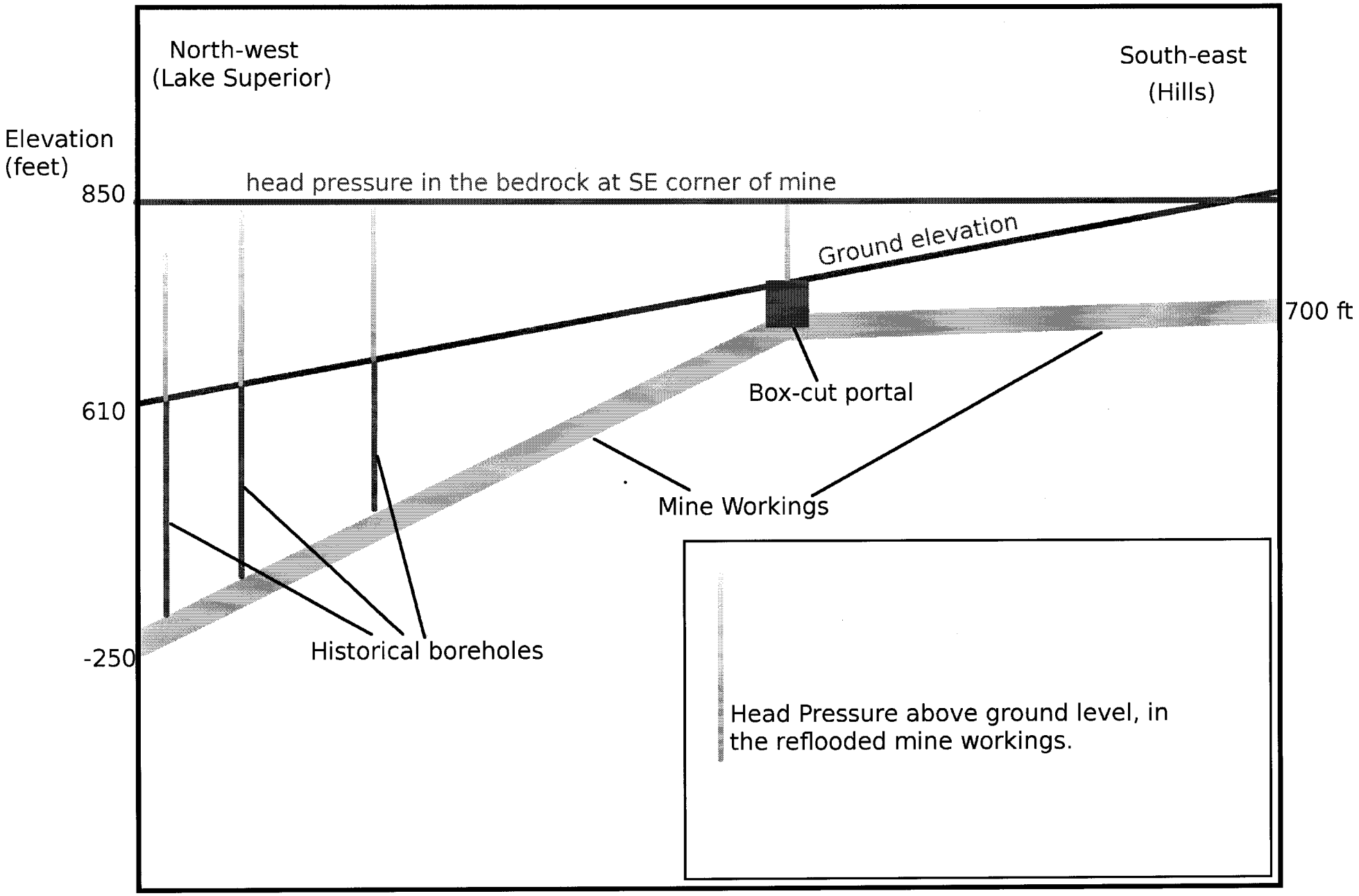
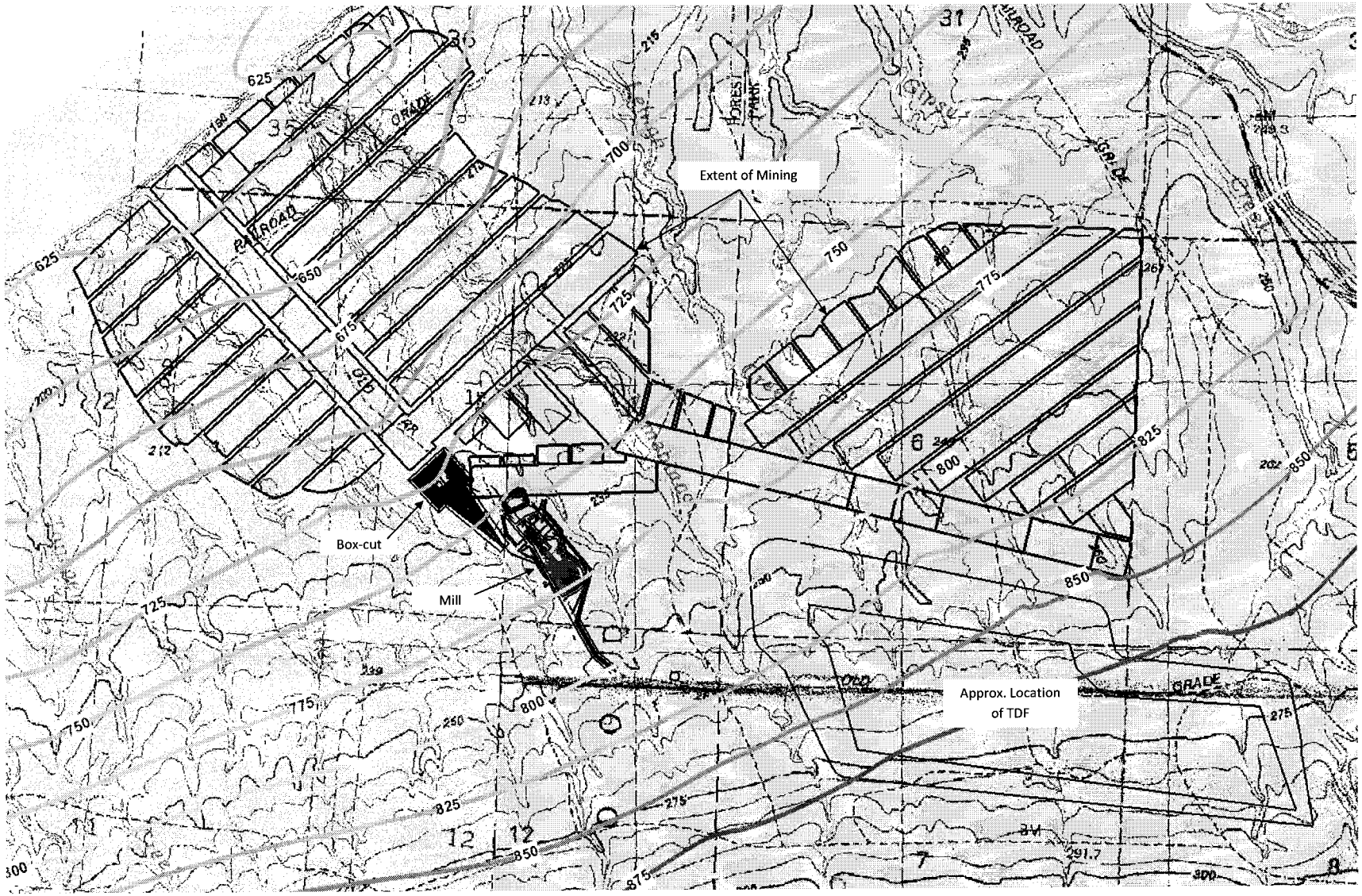


Figure 1. Head pressures in the Copperwood reflooded mine in relation to the box-cut portal and historical exploration borings.



Appendix 202.5.2-2b: Ground Water Modeling SCENARIO #1 – Map View of Head Solution at the Bottom of the Nonesuch Shale (Layer 16) at the End of Stress Period #14 (21 Years After Dewatering); Contour Interval 25ft.

203.3.6.6. Monitoring the Geochemical Characterization During the Proposed Mining Operation to Calibrate and Adjust Predictions and Model Calculations

The chemical composition of three different contact waters are the best monitors of geochemical characterization during proposed mining operations: mine discharge water, TDF pond water, and TDF drain water. The chemical composition of each of these three waters will be measured on a regular basis and reported to DEQ as required by permit. These data will be used to calibrate and adjust model predictions.

203.3.7. Locations, Depths, and Contours of Open Pits

A general facilities layout drawing showing the location of the box cut and conceptual design for the box cut can be referenced in the Pre-Feasibility Study (Appendix A). This provided a conceptual location and design that was used in the general layout drawing titled Figure 16.30 and 16.31 as shown below.

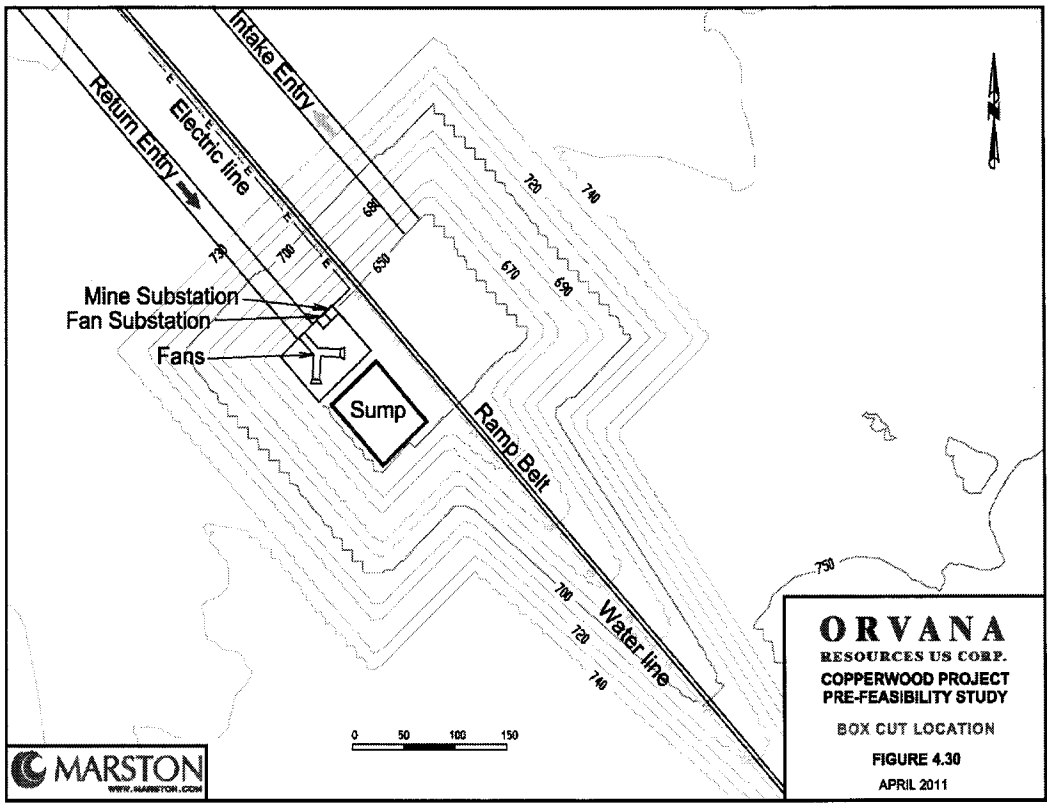
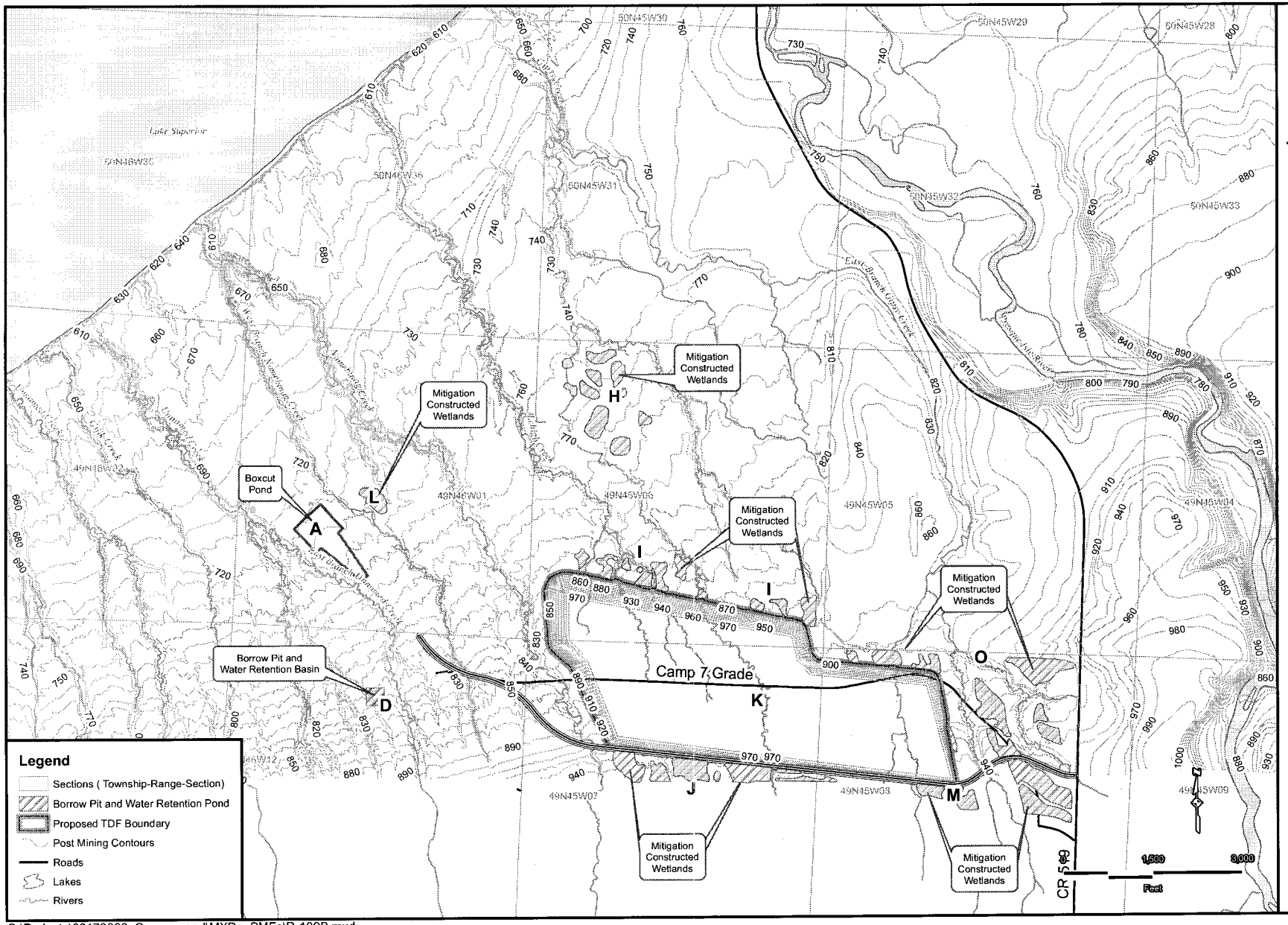


Figure 16.30, Box Cut Location as shown in the PFS Report.



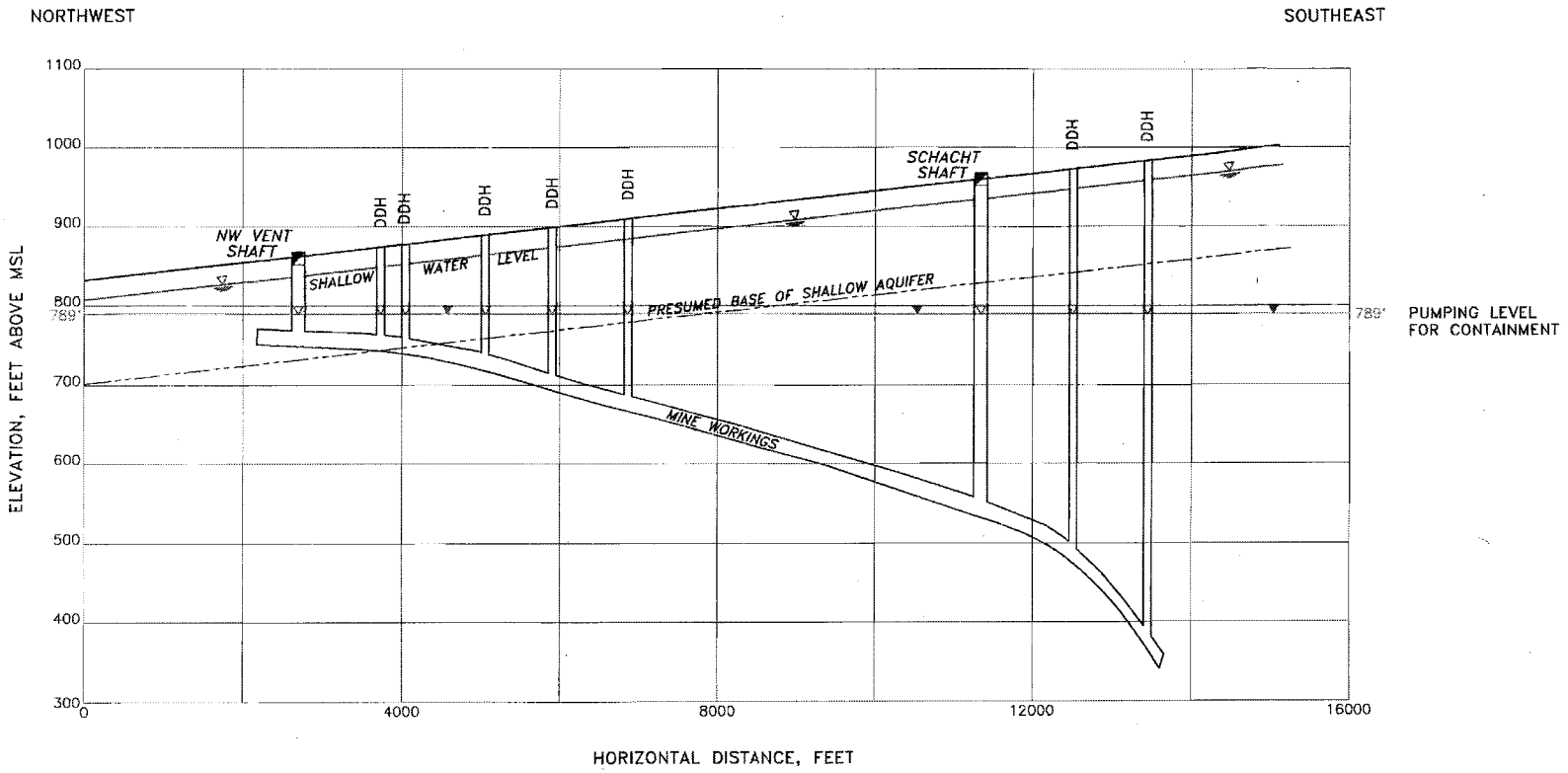
AECOM

www.aecom.com
Copyright ©2012 By: AECOM

ANTICIPATED POST-CLOSURE SURFACE FEATURES AND LAND SURFACE TOPOGRAPHY
ORVANA RESOURCES US CORP.
COPPERWOOD PROJECT
GOGEBIC COUNTY, MICHIGAN

Drawn:	JWW	1/4/2012
Approved:	ARB	1/4/2012
Scale:	AS SHOWN	
PROJECT NUMBER	60179066	
FIGURE NUMBER	R-109B	

O:\Projects\60179066_Copperwood\MXDs_PMFs\R-109B.mxd



LEGEND:

▽ WATER LEVEL IN SHALLOW AQUIFER

▼ WATER LEVEL IN MINE WORKINGS

DDH DIAMOND DRILLHOLE

NOT TO SCALE

SEE RESPONSE TO COMMENT 3 FOR LOCATION MAP

RESPONSE TO COMMENT 5:
SCHEMATIC SHOWING
WATER LEVEL RELATIONSHIP

SMI
SHEPHERD MILLER, INC.

Date:	APRIL, 1995
Project:	461
File:	XSECT-HH

White Pine Mine reflooding plan.